

## Improvements in or relating to lawn-mowers

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### Abstract

402,223. Lawn-mowers. BERGWALL, E., Vörnamo, Sweden. Oct. 7, 1932, No. 27916. Convention date, Dec. 3, 1931. [Class 6 (ii).] A lawn-mower comprises cutting blades 1a, 1b, 1c mounted on arms 6-9 on a shaft 3 and forming a cutter wheel 1 adapted to rotate in such a direction that the blades approach a fixed cutter 5 towards its bottom face. The blades 1a. are plane or substantially plane and each has such a position in a plane intersecting the axis of rotation of the cutters at an acute angle that their plane sides at each point along the cutter edge form an acute angle with that tangent to the surface of rotation drawn in a direction from said point reverse to said direction of rotation and lying in the plane of rotation of said point. The cutter edges are thus formed by intersection of the planes of the blades with the surface of rotation and are thus curved corresponding to conic sections. Where such surface is cylindrical, each cutter must lie entirely within the quadrant of an ellipse. The angle of inclination of the blades to the tangent is preferably less than'60 and may vary from 15 at one end of a blade to 35 at the other end. The blades 1a ... are mounted on pairs of the arms 6-9 by screws 13, 14, Fig. 6, on the arms having flattened necks 16 adapted to engage keyhole slots 11, 12 in the blades. Springs 15 are inserted between the blades and the arms, forked ends of the springs engaging the necks 16 and a projection 19 registering with an aperture 18 on the blade. The resilience of the mounting may be increased by lengthening the necks 16. That edge of a blade which first meets the fixed cutter may be rounded. When the blades are rectangular, the arms 6-9 are relatively displaced angularly in order to provide the inclin- tion of the blades. Blades in the form of truncated triangles may be provided thus obviating this displacement. The blades may be reversible, having cutting edges on opposite edges. The fixed cutter may be formed of invertable blades arranged in steps and having concave edges curved to correspond with the surface of rotation.

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## Description

COMPLET SPECIFICATION.

Improvements in or relating to Lawn-mowers.

I, ERNST BERGWALL, of Varnamo,

Sweden, a Swedish subject, Manager, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :

This invention relates to lawn-mowers of the kind having a fixed cutter and cutters rotatable in such a direction with respect to said fixed cutter that they approach said fixed cutter towards its bottom face.

In known lawn-mowers of the type, in which rotating cutters extend through the entire elective width of the machine, certain difficulties and inconveniences arise, especially with regard to the fastening, adjusting, sharpening and the strength of said cutters. If the cutters be made, for instance, of long flexible blades, whch when assembled must be bent into the required helical shape, special mechanical means for fitting and changing the cutters and skilful workmen for performing the work are with the result that changing the cutters becomes expensive and necessitates sending the machine to a workshop. On account of the necessary helical shape such a cutter is subjected to strains when the machine is working as well as when it is at rest, which leads to fracture of the cutter blade for no apparent reason.

This inconvenience becomes more marked in cutter blades with varying pitch, in which the strains consequently vary in different parts of the blade. On the other hand, if the rotatable cutters, be made as usual of relatively thick material and consequently fit in they must be given the required helical form in manufacture.

The present invention aims at obviating the foregoing inconveniences by an arrangement, which permits the cutters to be easily assembled and exchanged by unskilled workmen and without the aid of any mechanical appliance.

The novel notion is characterised in that the rotatable cutters are none or substantially round and that each of said cutters has such a position in a plane intersecting the axis of rotation of said cutters at an acute angle that the plane sides of each cutter at each point along the cutter edge form an acute angle with that tangent to the surface of rotation drawn in a direction from said point reverse to said direction of rotation and lying in the plane of rotation of said point.

In order more clearly to understand the invention, reference is made to the accompanying drawings which illustrate by way of example one embodiment thereof and in which :-

Figs. 1 and 2 illustrate diagrammatically in a longitudinal and an end view respectively the construction and arrangement of the cutters of the lawn-mower;

Fig. 3 is a plan view of said lawnmower;

Fig. 4 is a cross-section through fig. 1, same;

Fig. 5 shows two modifications of a cutter;

Fig. 6 is a longitudinal on an enlarged scale, through a cutter fastened on its supporting arms; and

Fig. 7 is a detail view thereof.

The lawn-mower is provided in known manner with a cutter wheel 1 supported on a shaft 3 driven from the supporting wheels 2 of the machine, the cutters of said cutter wheel 1 being adapted to operate with a fixed cutter 5 extending through the entire effective width of the machine and secured on the machine frame 4. The cutters on the cutter wheel 1 consist of short and plane cutter blades 1a, 1b, 1c, which, in the embodiment illustrated, are arranged in three groups supported by arms 6, 7, 8, 9 projecting from the shaft 3, the cutters 1a being supported on the arms 6 and 7, the cutters 1b supported on the arms 7 and 8, and the cutters 1c supported on the arms 8 and 9, in such manner that on the rotation of the cutter wheel, the cutters successively cooperate with the fixed cutter 5, with respect to which every movable cutter has an inclined position, so that a shearing effect will be obtained. In the embodiment illustrated each cutter group comprises three cutter blades but, of course, the number of cutter blades may be suited to the circumstances, the effective diameter of the cutter wheel, the gear ratio between the supporting wheels of the machine and the shaft 3 etc. The fastening of the cutter blades 1a, 1b, 1c on their supporting arms 6, 7, 8, 9 is illustrated in Fig. 6. As shown, the cutter blade is provided with two apertures 11, 12 at a distance from each other corresponding to the distance between fastening screws 13, 14 applied on the arms, with the screw heads fitting to the apertures in the cutter, and projecting from the arms so that a space is left corresponding to the total thickness of the cutter blade and a pressing or holding spring 15.

The neck 16 of the screw (which may be flattened) fits to a side notch 17 in each aperture 11, 12. The holding spring 15 is formed with L-shaped ends (see

Fig. 7) and has such a length that the ends embrace the necks 16 when the spring is inserted between the screws,

as shown in Fig. 6. Furthermore, the cutter Made 1a is provided with a smaller central I aperture 18, in which a projection 19 on the holding spr'ng engages at the application of the cutter blade. This application is performed in such manner that the cutter blade after Inserting of the sprint 15 between the fastening screws 13, 14 with the forked ends embracing the screw necks, is put over the serew heads, which pass through the apertures 11, 12, on to the sprang 15 and is thereafter slid to the left in Fi.,, 6, so that the screw necks engage into the notches 17. When the blade has been slid as far as possible, i. e. into proyer fastening position, the projection 19 on the spring engages in the e aperture 18 of the cutter and secures the. cutter blade in this position against sliding. In order to disengage the blade it is only neessary to press the projection 19 out of the aperture 18, slide back the blade and remove It over the screw heads withoutst altering the screws.

The essential feature of the present invention consists in the construction and arrangement of. the rotatable cutters 1a, 1b, 1c of the lawn-mower, and Figs. 1 and 2 facilitate the understanding thereof.

The cutters 1a. 1b, 1c as well as the fixed cutter 5 are quite plane and Tzreferablly made of thin nelble steel plate, band steel or the liste. The edges 20 of the rotat- ing cutters are rounded and illustrated in the example in which the cnt'ng surfæe has a cylindrical form. each cutter edge forms a nart of an ellintic line, while the edge 50 of the fixed cutter is straight formina the generatrix to the surface obtained bv rotation of the cutters. The effective, edge 20 of each rotating cutter must, of course, lie in this surfæe nd forms consequently the line of intersec- tion between the plane of the movable cutter and the cylmcirical cutting surface.

Each rotating cutter is position in such a way that the plane soues at each point along the cutter edge form an acute angle with that tangent to the surface of rotation drawn in a direction from said point reverse to said direction of rotation and lying in the plane of rotation of said- point.

For this purpose each rotating cutter must lie entirely within one of the quadrants of the ellipse, as shown in Figs.

1 and 2. As can The easily understood, the degree of the aforesaid acute angle will thus vary at different points along the edge of the cutter blade. Said angle is preferably less than 60 . According to Fig. 4 the position of the cutter blades is such that the angle varies from about 15 at the one end of the cutter to about 35 at the other end of the same. The angles which should be chosen in order to give the best cutting result at a minimum of consumption of power depends on the exist'ng conditions, the construction of the nxed cutter etc. When the fixed cutter is made from thin flexible steel plate, as aforementioned, and is attached on the frame at a relative long distance from the cutter edge, the cutters may make contact with each other with a certain flexibility of the fixed cutter, whereby the arrangement will be selfsharpening. In order to avoid pushing effect, when a rotating cutter makes con- tact with the nxed cutter, the edge 21 of the rotating cutter, which at first touclies the fixed cutter, isrounded (Fig. 5), so that the cutters will make a. soft contact with each other. All the cutters, thus also the rotating cutters, may ! be yieldinaly attache to the frame and the arms, respectively, for which purpose the cutter holding spring 15 may be used Xf the prongs of the forked ends are bent, so that they press the cutter yieldingly against the screw heads. In order to obtain a suitable movement of the cutter the screw necks must be made higher and, if necessary, the pronoms be lengthened, for instance, as shown in Fig. 7.

In Fig. 5 twod'nerent.modifications of the rotatable cutters are shown, the cutter 1a drawn in full lines and havons substantially a rectangular shape and the cutter 1A drawn in dotted and dashed lines and having the shaT) e of a truncated frianowle.

As stated the edge of the rotatable cutter must incline to the fixed cutter in the illustrated embodiment, i. e. incline to the generatrix of the cutting surface of rotation. Conseqnently the arms n. 7, etc. of the cutter wheel mmat he amnmlarly displaced to each other when the cutters are rectangular, as shown in Fig. 4. As may be easily understood this displace- ment of-the arms is avoided, when the cutter has the form 1A, since the edges of this cutter owing to the triangular shape take the required incline position when being attached to the arms which are placed axially behind each other and not angularly displaced, which arms, however, owing to the adjusting of each cutter, must have different lengths at the two ends of the cutter.

In the embodiments illustrated also the opposite longitudinal sides of the cutters are provided with cuttin, edges, which are arrange in such manner relatively to the fastening means of the blade that one edge or the other may be placed in cutting position by turning the blade.

In the embodiment of the cutter wheel 1 shown in Fig. 3 the number of the arms at the ends of the wheel must, of course, be three, while the number of the other arms must be six. If the rotating cutters are not arranged in groups but consist of plane cutters extending from one end of the cutter wheel to the other end of the same, the edges of the cutters may continue, for instance, from the smallest angle'between the cutter plane and the corresponding tangent shown in Fig-. 4, to somewhat less than a right angle.

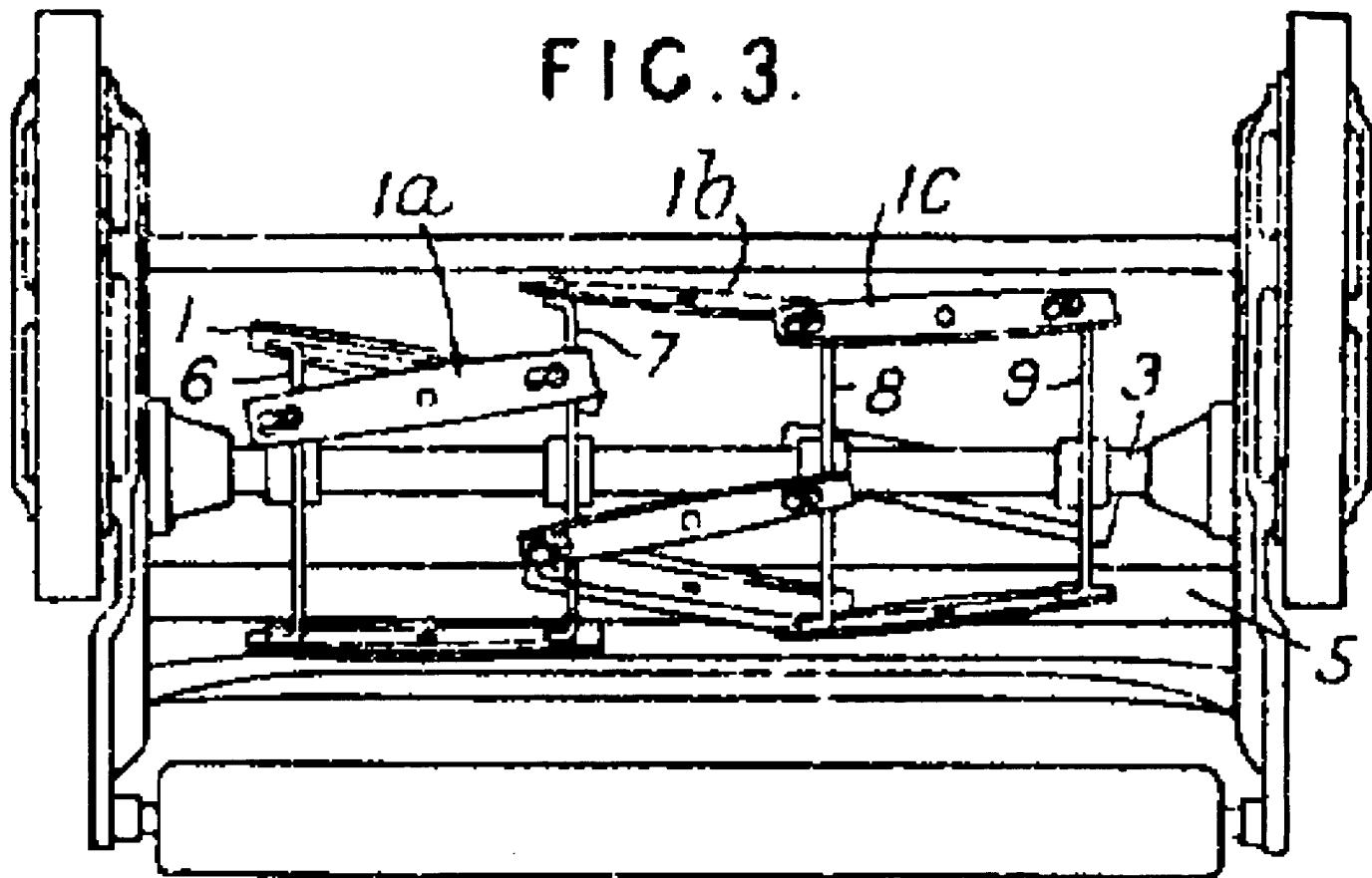
## Claims

It is obvious that the arrangement may be modified in many ways without departing from the scope of the invention as defined in the appended claims. Thus for example the fixed cutter may be divided into cutter blades, which are arranged in steps in inclined position and invertible, for forming edges along the opposite sides, said blades having concave edges curved after the cutting surface of rotation. The surface of rotation may also be conical instead of cylindrical, and in such case the curve line of the cutter edge corresponds to the curve of a conic section. The cutters cooperating with the holding springs may also be slidable in another direction, determined by the location of the notches relative to the apertures 11, 12, for instance, in transversal direction.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is :-

- 1). A lawn-mower provided with a fixed cutter and with cutters rotatable in such a direction with respect to said fixed cutter that they approach the fixed cutter towards its bottom face, characterised in that the rotatable cutters are T-shaped or substantially plane and that each of said cutters has such a position in a plane intersecting the axis of rotation of said cutters at an acute angle that the plane sides of each cutter at each point along the cutter edge form an acute angle with that tangent to the surface of rotation drawn in a direction from said point reverse to said direction of rotation and lying in the plane of rotation of said point.
- 2). Lawn-mower as set forth in claim 1, in which the position of the rotatable cutters on the cutter wheel is such that the angle between the plane of each cutter and the plane tangential to the surface of rotation through any point on the edge line of the cutter blade is less than 60°.
- 3). Lawn-mower as set forth in claim 1, in which the cutter edge is formed as part of a quadrant of an ellipse.
- 4). Lawn-mower as set forth in any of the preceding claims, in which the cutters preferably made from thin flexible material have two edges which are arranged relatively to the fastening means of said cutters in such manner that any edge may be placed in cutting position by turning the cutter.
- 5). Lawn-mower as set forth in claim 4, in which the fastening means of each cutter blade consists of two buttons, screws or the like fixed on the cutter wheel with freely positioned necks, the cutter blade being slid over the heads of said screws or the like, so that the necks engage into notches, which are formed in apertures in the cutter blade adapted to permit the passage of the heads therethrough, a plate spring or the like which is preferably provided with forked ends for embracing the necks of the fastening screws being pressed against the blade on the side opposite to the screw heads, said plate spring or the like being provided with a projection, which in the proper fastening position of the cutter blade engages in a corresponding aperture in the said blade, thereby preventing the cutter blade from sliding back and becoming disengaged.
- 6). Lawn-mower as set forth in claim 5, in which, in order to maintain the shearing effect of the cutters even after wear, plate springs or the like are arranged to coact with the cutter blades in such manner as to elastically press the co-operating rotatable and stationary cutter blades together.
- 7). Lawn-mower as set forth in any of the preceding claims, in which the edges of the rotatable cutter blades are rounded at that end which during the movement at first touches the fixed cutter, so that the co-operation of the cutter blades will be initiated without shock.
- 8). The lawn-mower, constructed, arranged and adapted to operate, substantially as described with reference to the accompanying ~ ~ ~ ~ ~

FIG. 3.



11 16 FIG. 6. 18 12 16

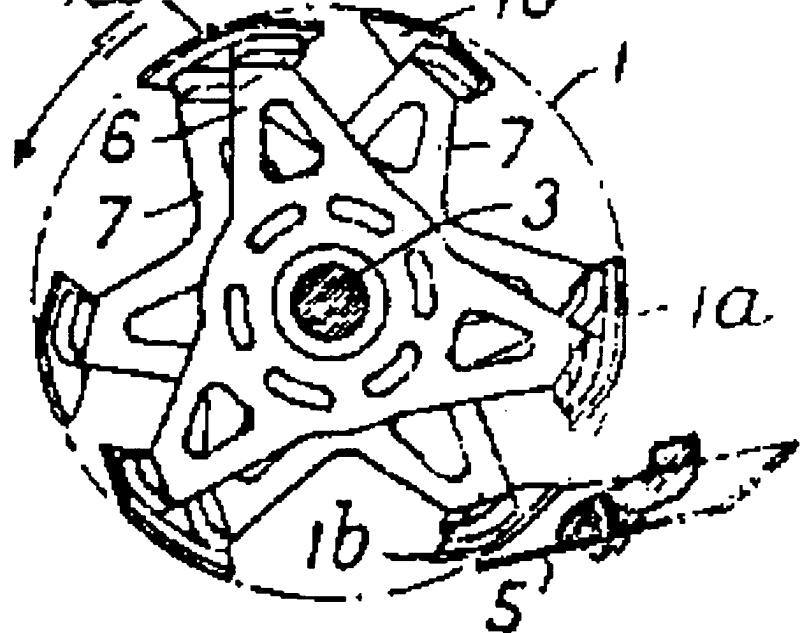
13 6

19 15

14

7 1a

1a FIG. 4. 1b



[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1

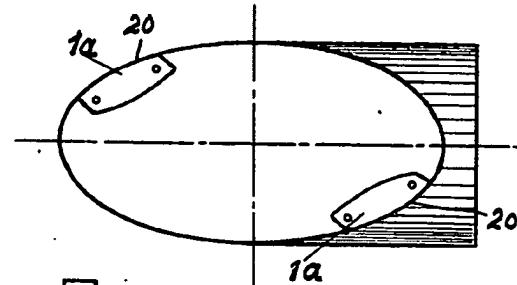


Fig. 2

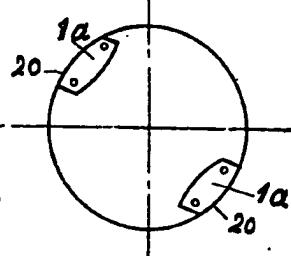


Fig. 3

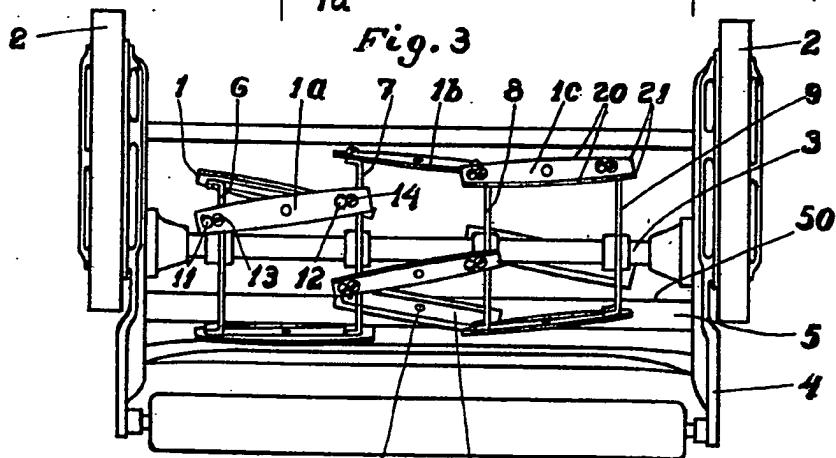


Fig. 4

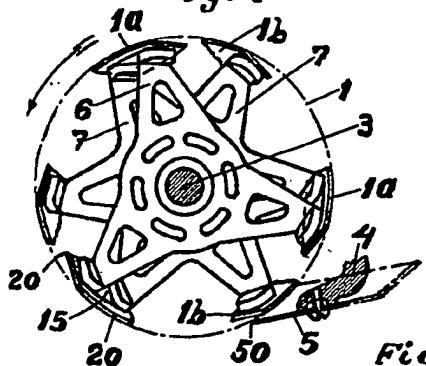


Fig. 5

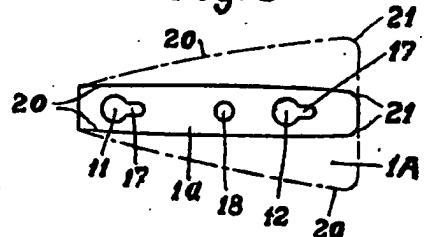


Fig. 7.

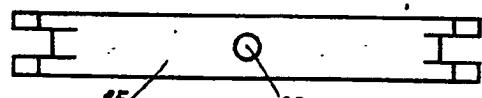
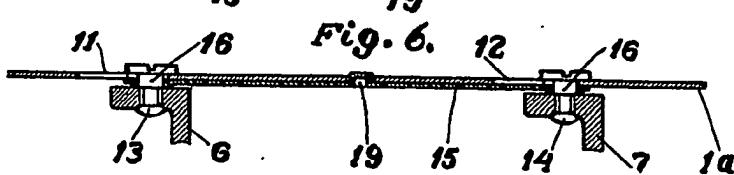


Fig. 6.



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